CLAIMS

1. An electrolytic processing apparatus comprising:

a processing electrode that can come close to a workpiece;

a feeding electrode for feeding electricity to the workpiece;

a holder for holding the workpiece;

a power source for applying a voltage between the processing electrode and the feeding electrode;

a fluid supply section for supplying a fluid between the workpiece and at least one of the processing electrode and the feeding electrode;

a sensor for measuring the electric conductivity of the fluid; and

a control section for changing the processing conditions based on the electric conductivity measured by the sensor.

2. The electrolytic processing apparatus according to claim 1, wherein an ion exchanger is disposed between the workpiece and at least one of the processing electrode and the feeding electrode.

3. The electrolytic processing apparatus according to claim 1, wherein the control section changes the processing conditions during or after electrolytic processing of the workpiece.

4. The electrolytic processing apparatus according to claim 1, wherein the control section changes the processing

conditions by changing the flow rate of the fluid supplied from the fluid supply section.

5. The electrolytic processing apparatus according to claim 1, wherein the sensor is disposed in the vicinity of the processing electrode or the feeding electrode.

6. The electrolytic processing apparatus according to claim 1, wherein the sensor is disposed at the fluid supply section.

7. The electrolytic processing apparatus according to claim 1, wherein the sensor is disposed at a fluid discharge section for discharging the fluid supplied from the fluid supply section.

8. The electrolytic processing apparatus according to claim 1, wherein the fluid supplied from the fluid supply section is pure water, ultrapure water or a fluid having an electric conductivity of not more than 500 μS/cm.

9. An electrolytic processing apparatus comprising:

a processing electrode;

a feeding electrode for feeding electricity to a workpiece;

an ion exchanger disposed between the workpiece and at least one of the processing electrode and the feeding electrode;

a holder for holding the workpiece and bringing the workpiece close to or into contact with the ion exchanger;

a power source for applying a voltage between the processing

electrode and the feeding electrode;

a fluid supply section for supplying a fluid between the workpiece and the electrode in which the ion exchanger is disposed;

a sensor for measuring the electric conductivity of the fluid; and

a contaminant removing section for removing contaminants on the surface or in the interior of the ion exchanger based on the electric conductivity measured by the sensor.

10. The electrolytic processing apparatus according to claim 9, wherein the contaminant removing section comprises a regeneration section for regenerating the ion exchanger.

11. The electrolytic processing apparatus according to claim 9, wherein the contaminant removing section removes the contaminants during or after electrolytic processing of the workpiece.

12. The electrolytic processing apparatus according to claim 9, wherein the sensor is disposed at the contaminant removing section.

13. The electrolytic processing apparatus according to claim 9, wherein the sensor is disposed in the vicinity of the processing electrode or the feeding electrode.

14. The electrolytic processing apparatus according to claim 9, wherein the sensor is disposed at the fluid supply section.

15. The electrolytic processing apparatus according to claim 9, wherein the sensor is disposed at a fluid discharge section for discharging the fluid supplied from the fluid supply section.

16. The electrolytic processing apparatus according to claim 9, wherein the fluid supplied from the fluid supply section is pure water, ultrapure water or a fluid having an electric conductivity of not more than 500 μS/cm.

17. An electrolytic processing apparatus comprising:

a processing electrode that can come close to a workpiece;

a feeding electrode for feeding electricity to the workpiece;

a holder for holding the workpiece;

a power source for applying a voltage between the processing electrode and the feeding electrode;

a fluid supply section for supplying a fluid between the workpiece and at least one of the processing electrode and the feeding electrode;

a sensor for measuring the resistance between the processing electrode and the feeding electrode; and

a control section for controlling the operation of the apparatus based on the resistance measured by the sensor.

18. The electrolytic processing apparatus according to claim 17, wherein an ion exchanger is disposed between the

workpiece and at least one of the processing electrode and the feeding electrode.

19. The electrolytic processing apparatus according to claim 17, wherein the sensor is disposed in the vicinity of the processing electrode or the feeding electrode.

20. The electrolytic processing apparatus according to claim 17, wherein the sensor is disposed at the fluid supply section.

21. The electrolytic processing apparatus according to claim 17, wherein the sensor is disposed at a fluid discharge section for discharging the fluid supplied from the fluid supply section.

22. The electrolytic processing apparatus according to claim 17, wherein the fluid supplied from the fluid supply section is pure water, ultrapure water or a fluid having an electric conductivity of not more than 500 μS/cm.

23. An electrolytic processing method comprising:

allowing a workpiece to be close to or in contact with a processing electrode;

applying a voltage between the processing electrode and a feeding electrode for feeding electricity to the workpiece;

supplying a fluid between the workpiece and at least one of the processing electrode and the feeding electrode;

measuring the electric conductivity of the fluid; and

changing the processing conditions based on the measured electric conductivity.

24. The electrolytic processing method according to claim 23, wherein an ion exchanger is disposed between the workpiece and at least one of the processing electrode and the feeding electrode.

25. The electrolytic processing method according to claim 23, wherein the processing conditions are changed during or after electrolytic processing of the workpiece.

26. The electrolytic processing method according to claim 23, wherein the processing conditions are changed by changing the flow rate of the fluid supplied between the workpiece and said at least one of the processing electrode and the feeding electrode.

27. The electrolytic processing method according to claim 23, wherein the fluid supplied between the workpiece and said at least one of the processing electrode and the feeding electrode is pure water, ultrapure water or a fluid having an electric conductivity of not more than 500 μS/cm.

28. An electrolytic processing method comprising:

disposing an ion exchanger between a workpiece and at least one of a processing electrode and a feeding electrode for feeding

electricity to the workpiece;

allowing the workpiece to be close to or in contact with the ion exchanger;

applying a voltage between the processing electrode and the feeding electrode;

supplying a fluid between the workpiece and the electrode in which the ion exchanger is disposed;

measuring the electric conductivity of the fluid; and

removing contaminants on the surface or in the interior of the ion exchanger based on the measured electric conductivity.

29. The electrolytic processing method according to claim 28, wherein the contaminants are removed during or after electrolytic processing of the workpiece.

30. The electrolytic processing method according to claim 28, wherein the fluid supplied between the workpiece and said at least one of the processing electrode and the feeding electrode is pure water, ultrapure water or a fluid having an electric conductivity of not more than 500 μS/cm.

31. An electrolytic processing apparatus comprising:

a processing electrode;

a feeding electrode for feeding electricity to a workpiece;

an ion exchanger disposed at least one of between the workpiece and the processing electrode, and between the workpiece and the feeding electrode;

a power source for applying a pulse voltage between the

processing electrode and the feeding electrode; and

a liquid supply section for supplying a liquid between the workpiece and at least one of the processing electrode and the feeding electrode.

32. The electrolytic processing apparatus according to claim 31, wherein the liquid is pure water, ultrapure water or a liquid having an electric conductivity of not more than 500 μS/cm.

33. The electrolytic processing apparatus according to claim 31, wherein the lowest potential of the pulse voltage periodically becomes zero or a negative potential.

34. The electrolytic processing apparatus according to claim 31, wherein the waveform of the pulse voltage is part of a square wave or a sine curve.

35. The electrolytic processing apparatus according to claim 31, wherein the duty ratio of positive potential of the pulse voltage is within the range of 10-97%.

36. The electrolytic processing apparatus according to claim 31, wherein the current density of an electric current flowing in the surface of a workpiece in contact with the ion exchanger is 0.1 to 100 A/cm^2.

37. The electrolytic processing apparatus according to

claim 31, wherein the positive potential time in one cycle of the pulse voltage is 50 μs to 7 sec.

38. The electrolytic processing apparatus according to claim 31, wherein the liquid has been degassed to a dissolved oxygen concentration of 1 ppm or less.

39. An electrolytic processing method comprising:

disposing an ion exchanger between at least one of between a workpiece and a processing electrode, and between the workpiece and a feeding electrode;

allowing the workpiece to be close to the processing electrode;

applying a pulse voltage between the processing electrode and the feeding electrode; and

processing the workpiece while supplying a liquid between the workpiece and at least one of the processing electrode and the feeding electrode.

40. The electrolytic processing method according to claim 39, wherein the liquid is pure water, ultrapure water or a liquid having an electric conductivity of not more than 500 μS/cm.

41. The electrolytic processing method according to claim 39, wherein the lowest potential of the pulse voltage periodically becomes zero or a negative potential.

42. The electrolytic processing method according to claim

39, wherein the waveform of the pulse voltage is part of a square wave or a sine curve.

43. The electrolytic processing method according to claim 39, wherein the duty ratio of positive potential of the pulse voltage is within the range of 10-97%.

44. The electrolytic processing method according to claim 39, wherein the current density of an electric current flowing in the surface of a workpiece in contact with the ion exchanger is 0.1 to 100 A/cm^2.

45. The electrolytic processing method according to claim 39, wherein the positive potential time in one cycle of the pulse voltage is 50 μs to 7 sec.

46. The electrolytic processing method according to claim 39, wherein the liquid has been degassed to a dissolved oxygen concentration of 1 ppm or less.

47. An electrolytic processing method comprising:

electrolytically processing a surface of a workpiece by providing a processing electrode and a feeding electrode for feeding electricity to the workpiece, applying a voltage between the processing electrode and the feeding electrode, allowing a liquid and a partition member to be present between the processing electrode and the workpiece, allowing the workpiece to be close to or in contact with the processing electrode, and allowing

the workpiece and the processing electrode to make a relative movement;

stopping the application of the voltage between the processing electrode and the feeding electrode after electrolytically processing the surface of the workpiece until a predetermined processing amount is reached;

allowing the processing electrode and the workpiece to make a relative movement for a given length of time; and

separating the workpiece from the processing electrode.

48. The electrolytic processing method according to claim 47, wherein an ion exchanger is disposed between the workpiece and at least one of the processing electrode and the feeding electrode.

49. The electrolytic processing method according to claim 47, wherein the partition member to be present between the processing electrode and the workpiece is an ion exchanger disposed such that it covers the processing electrode or the feeding electrode, a buffer member, or a partition disposed in the vicinity of the processing electrode.

50. The electrolytic processing method according to claim 47, wherein the processing electrode and the feeding electrode are disposed such that they face the surface of the workpiece.

51. The electrolytic processing method according to claim 47, wherein the apparatus determines whether the predetermined

processing amount is reached by a processing amount measurement section or by time management.

52. The electrolytic processing method according to claim 47, wherein the relative movement between the processing electrode and the workpiece after the stoppage of voltage application is carried out for 1-60 seconds.

53. An electrolytic processing apparatus comprising:

an electrode section including a plurality of electrodes;

a holder for holding a workpiece, capable of bringing the workpiece close to or into contact with the electrodes;

a power source to be connected to the electrodes of the electrode section;

a partition member disposed such that it can make contact with the surface of the workpiece;

a liquid supply section for supplying a liquid between at least one of the electrodes, the partition member and the workpiece; and

a drive section for allowing the electrode section and the workpiece to make a relative movement;

wherein application of a voltage is stopped after processing the workpiece until a predetermined processing amount is reached, and the electrode section and the workpiece is allowed to make a relative movement for a given length of time while supplying the liquid between at least one of the electrodes, the partition member and the workpiece.

54. The electrolytic processing apparatus according to claim 53, wherein an ion exchanger is mounted on at least one of the electrodes such that it covers the electrode.

55. The electrolytic processing apparatus according to claim 53, wherein the electrodes are comprised of processing electrodes and feeding electrodes, and the processing electrodes and the feeding electrodes are disposed such that they face the surface of the workpiece.

56. The electrolytic processing apparatus according to claim 55, wherein the partition member is disposed between the processing electrode and the feeding electrode.

57. The electrolytic processing apparatus according to claim 53, wherein the partition member is comprised of an ion exchanger, a porous polymer material, a fibrous material or a polishing pad.

58. The electrolytic processing apparatus according to claim 53, wherein the apparatus determines whether the predetermined processing amount is reached by a processing amount measurement section or by time management.

59. An electrolytic processing apparatus comprising:

a processing electrode;

a feeding electrode;

a holder for holding a workpiece, capable of bringing the

workpiece close to or into contact with the processing electrode;

a power source to be connected to the processing electrode and the feeding electrode;

a contact member disposed between the workpiece and at least one of the processing electrode and the feeding electrode, and capable of making contact with the workpiece;

a liquid supply section for supplying a liquid between the workpiece and at least one of the processing electrode and the feeding electrode; and

a drive section for allowing the workpiece and at least one of the processing electrode and the feeding electrode to make a relative movement;

wherein application of a voltage is stopped after processing the workpiece until a predetermined processing amount is reached, and the workpiece and at least one of the processing electrode and the feeding electrode are allowed to make a relative movement for a given length of time.

60. The electrolytic processing apparatus according to claim 59, wherein the contact member is an ion exchanger or a buffer member having elasticity.

61. The electrolytic processing apparatus according to claim 59, wherein the processing electrode and the feeding electrode are disposed in the same direction.

62. The electrolytic processing apparatus according to claim 59, wherein the apparatus determines whether the

predetermined processing amount is reached by a processing amount measurement section or by time management.